

REMARKS

The Examiner admits, regarding the difference between the present invention and the inventions disclosed in U.S. Patent No. 3,321,533 to Patton, et al. and Japanese Laid-Open Patent Publications No. 2002-128886, No. 2002-293915, No. 2000-086755 and No. 2000-256457 that none of these references discloses the molecular weight or polyethylene oxide polymer product of the present invention, but states that, since these Japanese references disclose propylene oxide quite similar to that of the present invention, it would be obvious for those skilled in the art to replace the propylene oxide with the ethylene oxide of the present invention, and also that the present specification does not describe that unpredictably remarkable effects would be obtained by such replacement. However, the applicant of the present application believes that the present invention as claimed in claims 13-24 is not obvious from the cited art, as explained below.

The advantageous effects attained by adopting the claimed compositions are described on the last line on page 3 through page 4, line 7, as follows:

“As a result, we found that when a specific polymerization catalyst composition is used in the production of poly(ethylene oxide) by directly polymerization of ethylene oxide, the polymerization of ethylene oxide proceeds extremely satisfactorily and the molecular weight distribution becomes very sharp and, therefore, the molecular weight of the resulting polymer can be controlled within a specific range.”

“When the component A and the component B are employed together, the resulting catalyst “system” can initiate polymerization of ethylene oxide successfully to produce a molecular weight within a desired range of about 20,000 to about 200,000 with a narrow molecular weight distribution, which is characterized by a low polydispersity. Thus, it is possible to achieve the

polymerization of ethylene oxide in a high yield economically by direct polymerization.” (Page 4, lines 18-25.)

I. Explanation of the Cited References

U.S. Patent No. 3,321,533 (Ref. No. 1) discloses a process for preparing a “nonionic surfactant” from a metal alkyl. In this preparation process, R'-A1-(R)R' is used as an aluminum alkyl compound (Formula (II) in col. 2). This compound is oxidized, for example, by air oxidation, into R'O-A1-(OR)OR', and, thereafter, this compound is reacted with lower alkylene oxide in the presence of a basic hydroxide to produce a metal alkyl polyoxyalkylene compound A1[O(-R'''-O)_nR]R''₂ (compound represented by Formula (III) in col. 3). Then, this compound is hydrolyzed to obtain a nonionic surfactant represented by Formula (I) in col. 1, (R)-(O-R'''-)_n OH (wherein R represents a higher alkyl group or an aralkyl group; and R''' represents a lower alkylene group). Claim 1 also defines that trialkyl aluminum is oxidized at a temperature of about 50°C to 200°C. Example 1C in col. 5 describes the preparation of a nonionic surfactant represented by Formula (I) by using a C13-C17 α -olefin mixture as a starting material, heating this mixture, tri-isobutyl aluminum and a nickel catalyst at a temperature of 125°C to 130°C while stirring to produce an aluminum alkyl compound, introducing dry air to this product while stirring to perform oxidation, then adding ethylene oxide at a reaction temperature of 120°C to 150°C in the presence of sodium hydroxide to obtain an oxyalkylated product, and hydrolyzing this product.

Further, Japanese Publication No. 2002-128886 (Ref. No. 2) discloses a catalyst composition for the polymerization of propylene oxide, comprising a crown ether compound, an alkali metal alkoxide or an alkali metal hydroxide, a polyether polyol having a specific number average molecular weight, and a trialkyl aluminum compound, and a process for preparing a

propylene oxide polymer using the catalyst. In claim 3, potassium t-butoxide is exemplified as an alkali metal alkoxide for polymerization of propylene oxide.

Japanese Publication No. 2002-293915 (Ref. No. 3) discloses a catalyst composition for the polymerization of propylene oxide, comprising a crown ether compound, an alkali metal alkoxide or hydroxide or trialkyl silanoate, and a trialkyl aluminum compound and/or a triaryl aluminum compound, wherein the molar ratio among the three components is within a specific range, and a process for preparing a propylene oxide polymer using the catalyst. In claim 3, potassium t-butoxide is exemplified as an alkali metal alkoxide for polymerization of propylene oxide.

Further, Japanese Publication No. 2000-086755 (Ref. No. 4) describes a catalyst composition for polymerization of propylene oxide, comprising a crown ether compound, an alkali metal alkoxide or an alkali metal hydroxide, and organic Lewis acid, and a process for preparing a propylene oxide polymer using the catalyst. In paragraph 0009, potassium t-butoxide is exemplified as an alkali metal alkoxide for polymerization of propylene oxide.

Japanese Publication No. 2000-256457 (Ref. No. 5) discloses a catalyst composition for the polymerization of propylene oxide, comprising a crown ether compound, an alkali metal alkoxide or an alkali metal hydroxide, and organic Lewis acid, and a process for preparing a propylene oxide polymer using the catalyst, similar to Ref. No. 4. In paragraph 0008, potassium t-butoxide is exemplified as an alkali metal alkoxide for polymerization of propylene oxide.

II. Comparison Between the Present Invention and the Inventions of Reference Nos. 1-5

Firstly, when the present invention as claimed in claims 13-19 and the invention disclosed in Ref. No. 1 are compared, they are completely different in that, while the former invention relates to a catalyst composition for use in the preparation of polyethylene oxide of the general formula $H-(OCH_2CH_2)_n-OH$ having a molecular weight of 20,000 to 200,000, the latter invention relates to a catalyst composition for use in the preparation of a “nonionic surfactant” represented by the general formula $R-(O-R''')_n OH$ (wherein R represents a higher alkyl group or an aralkyl group; and R''' represents a lower alkylene group). Additionally, trialkyl aluminum functions as one component of the catalyst composition for use in the preparation of polyethylene oxide within a specific molecular weight range in the former invention, but is used as a starting material in the latter invention. The alkyl group remaining in the final product, surfactant, functions as a hydrophobic part. Thus, the two inventions are significantly different.

Additionally, when the present invention as claimed in claims 20-24 and the invention disclosed in Ref. No. 1 are compared, they are completely different in that, while the former invention relates to a process for preparing polyethylene oxide represented by the general formula $H-(OCH_2CH_2)_n-OH$ having a molecular weight ranging from 20,000 to 200,000, the latter invention relates to a process for preparing a “nonionic surfactant” represented by the general formula $R-(O-R''')_n OH$. Further, the process after the preparation of a polymerization catalyst composition comprising the Components A and B proceeds at one stage at room temperature (25°C in Examples 1 to 3) in the preparation process of the former invention, while the preparation process of the latter invention comprises the steps of oxidizing trialkyl aluminum at a high temperature (50°C to 200°C), oxyalkylating aluminum trialkoxide using ethylene oxide, and hydrolyzing the oxyalkylated product (see Example 1C). Ref. No. 1 does not disclose homopolymerization of ethylene oxide, and the two

processes are completely different in the reaction step or reaction conditions (reaction temperature). Thus, the preparation process of the present invention is different from that of the invention disclosed in Ref. No. 1. In the meantime, Ref. No. 1 neither discloses nor suggests the use of an alkali metal alkoxide.

As stated above, the present invention relating to a catalyst composition for use in the preparation of polyethylene oxide and a process for preparing polyethylene oxide is completely different from the invention disclosed in Ref. No. 1 cited in the Office Action, and additionally, Ref. No. 1 neither discloses nor suggests the catalyst composition and process for preparing polyethylene oxide according to the present invention. Thus, the present invention as claimed in claims 13-24 would not be obvious for those skilled in the art from the invention disclosed in Ref. No. 1.

Next, when the present invention as claimed in claim 17 an the inventions disclosed in Ref. Nos 1-5 are compared, they are different in that while claim 17 defines an invention relating to a catalyst composition for use in the preparation of polyethylene oxide, comprising potassium t-butoxide which is an alkali metal alkoxide as Component B and an organoaluminum compound as Component A, Ref. No. 1 merely discloses, as a process for preparing a nonionic surfactant comprising an ethylene oxide unit $(OCH_2CH_2)_n$ in the molecule, reacting the aluminum trialkoxide obtained by oxidation of trialkyl aluminum with ethylene oxide in the presence of an alkali metal hydroxide to produce an oxyalkylated product, and hydrolyzing this product, and neither discloses nor suggests a catalyst composition for use in the preparation of polyethylene oxide comprising potassium t-butoxide and an organoaluminum compound in combination.

Ref. Nos. 2-5 disclose potassium t-butoxide as one component of a catalyst composition for polymerization of propylene oxide. These catalyst compositions disclosed in the

References are intended for use in the polymerization of propylene oxide, and, additionally, comprise, as an essential component, crown ether into which an alkali metal ion can be incorporated. The composition disclosed in Ref. No. 2 further comprises a polyether polyol having a specific number average molecular weight, and the compositions disclosed in Ref. Nos. 4-5 further comprise Lewis acid as an essential component. On the other hand, the catalyst composition of the present invention does not contain crown ether, a polyether polyol or Lewis acid, and is different in components from the catalyst compositions disclosed in Ref. Nos. 2-5. Further, Ref. Nos. 2-5 relating to a catalyst composition for the polymerization of propylene oxide neither disclose nor suggest the catalyst composition of the present invention which is useful for preparing polyethylene oxide having the molecular weight within the range of 20,000 to 200,000 with a narrow molecular weight distribution.

Accordingly, those skilled in the art cannot accomplish the present invention as claimed in claim 17, based on Ref. Nos. 2-5 relating to a catalyst composition for use in the preparation of propylene oxide in the preparation of a nonionic surfactant represented by the general formula R-(O-R'''-)_nOH shown in Ref. No. 1. Further, even though an alkali metal alkoxide is used in place of an alkali metal hydroxide, in view of the disclosures of Ref. Nos. 2-5, in the preparation of the nonionic surfactant disclosed in Ref. No. 1, the ethylene oxide unit structure, adjacent to the alkyl group, is merely introduced. Thus, it is impossible to prepare polyethylene oxide (homopolymer) having a molecular weight ranging from 20,000 to 200,000 with a narrow molecular weight distribution, and the effects obtained in this case are evidently completely different from those obtained by the present invention as claimed in claim 17.

Therefore, the present invention as claimed in claim 17 would not be conceived by those skilled in the art from the inventions of Ref. Nos. 1-5.

As mentioned above, all of the inventions defined in claims 13-24 are not obvious from the inventions of Ref. Nos. 1-5 cited in the Office Action, and hence, withdrawal of the rejection is respectfully requested.

Wherefore, a favorable action is earnestly solicited.

Respectfully submitted,

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